[Coral-List] Sequencing of Porites Genome

craigdowns craigdowns at envirtue.com
Mon Sep 8 21:15:48 EDT 2003

- Previous message: [Coral-List] vacancy announcement-MPA programs, American Samoa
- Next message: [Coral-List] question regarding importation of red coral to the USA
- **Messages sorted by:** [date] [thread] [subject] [author]

Dear Coral List Server Members,

The sequence of a coral genome would provide a tremendous foundation for coral scientific research, as well as provide a basis for technology development that could benefit coral-reef resource management. Dr. Gary Ostrander (Johns Hopkins University) is leading an effort towards the goal of sequencing the genome of Porites lobata. We are soliciting letters of support for this endeavor from the coral reef scientific and management community. Once the genome is sequenced, the work will be published in a peer-reviewed journal and the entire genome will be made freely accessible to the public.

We have chosen Porites lobata because of its rising importance as a 'laboratory rat' in coral ecotoxicology, coral cell biology, coral immunity and coral neurophysiology. We have also chosen this species because of its extensive distribution in the Indian and Pacific Oceans, the Red Sea, and the Persian Gulf. Another important advantage of Porites over other species, such as Acroporids or Montastrea spp, is that Porites lacks some of the various biochemical interfering substances present in many coral families; substances that makes it very
difficult to near impossible to apply molecular and biochemical techniques without significant artifact. Finally, Porites lobata and Porites asteroides show high similarity for many of their enzymes and genes. It should be easy to adapt technologies that would utilize the gene sequence information of Porites lobata (such as PCR, gene array, ELISAs, Real-time PCR, immuno-histology) to Porites asteroides.

Attached to this email is a letter explaining this project in more detail, as well as guidelines for a letter of support.

If you have any questions, please don't hesitate to contact Gary (gofish at jhu.edu) or I.

Sincerely,

Craig

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craigdowns craigdowns at envirtue.com
Tue Sep 9 19:15:41 EDT 2003

- Previous message: [Coral-List] post-doc/graduate stipends available
- Next message: [Coral-List] Coral Genome Sequencing (3)
- **Messages sorted by:** [date] [thread] [subject] [author]

Dear Coral List Serv,

For some reason, the attachment never came through on the list serv, so I have pasted the letter below.

-Craig

Colleagues,

I am coordinating an effort to sequence (likely 6x coverage) the genome of Porites lobata. NHGRI has a deadline of October 10 for "white papers" for sequencing projects and I have enlisted TIGR (Steven Salzberg) and the President of EnVirtue Biotechnologies, Inc. (Craig Downs) as partners. This effort also has the endorsement of Craig Venter, founder of TIGR and President of The Center for the Advancement of Genomics (TCAG). If approved, the sequencing project would be undertaken by one of the NHGRI-funded sequencing centers. We believe it is likely that TIGR and its new Joint Technology Center will shortly

join that group of centers, with their new project to be headed by Dr. Venter.

A very significant part of the application is the letters of support from the community that anticipates using the genomic information that will be generated. In fact, I have learned from others who have written successful papers that these letters are essential and play a major role in determining the priority of the organisms for sequencing. To this end I am soliciting as many member of the coral reef community as possible to provide letters. Without a significant number of these letters (25+) this project has little chance of being selected and funded.

Letters should be no more than one page, must be signed, and should be on your institution's letterhead. Your letter must be specific and should include the following:

1. How will sequencing the Porties lobata genome will help your own work? Again, be as specific. What are you studying and what fundamental questions or experiments of significance will you now be able to do with this information? For example, you can just say, we'll expand our efforts in blah blah. Instead, state that your are interested in positional cloning of several genes of the XX disease family and we now have to clone every gene in the region of linkage that we've defined one at a time by screening libraries with degenerate primers, which works only some of the time and often gives us false positives, especially for the XX gene family which is complex. But if the sequence were available we'd just download the sequence, make PCR primers, and screen for mutations in our disease population. You should make it clear that you have the resources to use the sequence deformation and that you in fact will use it. In short, NHGRI wants to know that significant work will now be completed as a result of this effort.

2. How will sequencing of the Porites lobata genome help you in the funding of your work (regardless of the agency supporting you) and in particular will this bring others to the field? NHGRI wants to know that this will impact a significant number of individuals and may even expand the number of workers in the field. It would be a severe criticism to NHGRI if they funded the sequence of an organism for 9+ million dollars and 3 years later only a handful of groups were using the information.

3. If you agency or organization can provide any funding toward this effort in any capacity (even "in-kind" efforts) it should be mentioned. For example, it would be great if an agency were willing to underwrite the cost of a meeting, once the data becomes available, to train individuals on how to use the data etc. I have been told that any kind of support from other organizations will carry a lot of weight.

4. A minor point, check your ego at the door. While I have asked you to tell me how the sequencing of Porties lobata will help you.. I do not need a lengthy discourse on your own research. What they are

looking for is how completion of this project going to be of global significance. So, as much as possible please, provide some example of the cosmic significance of this undertaking. Feel free to comment aboutwork that may not be related to your own corner of the world/reef! I have been told by someone who helped write the guidelines the committee is not interested so much in the quality/quantity of the science that you have done in the past as they are in what will come out of this effort. They want to see vision. In fact, they don't even ask for CV's.

5. I need your letter by October 1st. Please send me a hard copy or at least a FAX by that time to: Dr. Gary K. Ostrander, Department of Biology, 237 Mergenthaler Hall, 3400 North Charles Street, Johns Hopkins University, Baltimore, MD 21218. My FAX number is 410/516-4100 and you can call (410/516-8215) or email (gofish at jhu.edu) with questions.

6. Please give very serious consideration to this request. This may be our one opportunity to accomplish this objective in the near future. Many groups are gearing up for large scale sequencing projects and the competition to access this resources will only get stiffer. Also, there are a finite number of centers and "lanes" available for sequencing at this time.

7. Finally, if you would be kind enough to drop me an email now as to what the major impact of this project will be for you..I can be sure to include it in the text of the white paper now.

Thank you in advance,

Gary K. Ostrander
Department of Biology
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Mikhail Matz mvmatz at yahoo.com
Wed Sep 10 15:05:21 EDT 2003

- Previous message: [Coral-List] Coral Genome Sequencing (3)
- Next message: [Coral-List] Porite genome 2
- **Messages sorted by:** [date] [thread] [subject] [author]

Dear Craig and all,

The Porites candidate came as a surprize to me. My support would be for Montastraea (since my own molecular work is on M.cavernosa, and by the way, I never encountered the technical difficulties that Craig refers to), or Acropora. These two seem to me much more advanced in molecular terms than Porites.

I do believe that having a coral genome sequenced would greatly benefit all of us and science in general, however, it is critical to select a proper species. I would be very glad to hear opinion of the list on this matter.

In fact, I heard rumors of a couple other projects started that would lead to coral genomic studies, but nothing definite. Would be great to know for sure what is going on (or going to be going on) in this area!

cheers

Mike Matz

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http://www.whitney.ufl.edu/research_programs/matz.htm

Todd Barber reefball at reefball.com
Thu Sep 11 10:18:55 EDT 2003

- Previous message: [Coral-List] Porite genome 2
- Next message: [Coral-List] Porite genome 2
- **Messages sorted by:** [date] [thread] [subject] [author]

As a forward thinking possibility, consider Acropora Arabia from Kuwait which to my knowledge is the Acropora species with that has adapted to themost enviromental changes likey to be seen in our earth's future. (Wide temperature variations, high salenity, high turbidity, oil on the surface, etc.). Perhaps we could, in the future, gain genetic insights to help other fast growing acroporas to maintain their distribution better.

Thanks,

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Tarr, Bradley A SAJ Bradley.A.Tarr at saj02.usace.army.mil
Fri Sep 12 10:33:23 EDT 2003

- Previous message: [Coral-List] Invitation to ICRI CPC Meeting
- Next message: [Coral-List] Request information on bleaching or no-bleaching from Okinawa, Japan
- **Messages sorted by:** [date] [thread] [subject] [author]

For that matter, the Persian (Arabian) Gulf contains several species of Porites and Acropora that have been subjected to and withstood extreme ranges in sea temperatures (17-35C) and high salinities (40-42+ppt).

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craigdowns craigdowns at envirtue.com
Mon Sep 15 10:32:52 EDT 2003

- Previous message: [Coral-List] Request information on bleaching or no-bleaching from Okinawa, Japan
- Next message: [Coral-List] ALGAL reproduction
- **Messages sorted by:** [date] [thread] [subject] [author]

Colleagues,

There have been some questions raised by some of you about the availability of the Porities sequence data to the scientific community. We are writing to assure you that this data will be freely available to everyone in the community.

If approved by NHGRI, the coral genome will be sequenced by one of the NHGRI Centers, which we anticipate will be the new center at TIGR called the Joint Technology Center (final funding decisions will be announced before Sept 30). All data from all NHGRI projects at TIGR's Joint Technology Center will be released with absolutely no restrictions. There will be no costs to obtain the data, and there will be nothing getting in the way of anyone who wants to download it. You won't have to click on a license, you won't have to identify yourself, and you won't have to agree to any restrictive policies. You can redistribute the data, publish new findings based on it, or even sell it if you want!

In our grant application to NHGRI, we emphasized our commitment to free, unrestricted release of all genome data AND all analyses of that data done by the Joint Technology Center, if we are funded. We will produce genome assemblies and automated analyses very rapidly and wewill release those immediately to the community.

We cannot emphasize how important it is for us to make it clear to the coral research community what our intentions are on this data release issue. This will be a public resource, publicly funded and intended to benefit the entire scientific community. No one will have special access, not even the center generating the data.

Please feel free to contact us if you have additional questions or concerns or would like to discuss this matter further.

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Craig Downs
gofish at jhu.edu salzberg at tigr.com
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Andy Bruckner Andy.Bruckner at noaa.gov
Mon Sep 15 17:16:15 EDT 2003

- Previous message: [Coral-List] Porite genome 2
- Next message: [Coral-List] Porite genome 2
- **Messages sorted by:** [date] [thread] [subject] [author]

Hi folks,

I would like to add my 2 cents to this issue. Not sure if it is too late, but I would side with Mikhail. It seems to me that (if it is a Caribbean species) one of the Caribbean Montastraea annularis complex species would be our first choice, given that this is the most

important coral today on Caribbean reefs and it is affected by multiple diseases. My second choice would be Acropora palmata for the same reasons.

Andy

Robert Buddemeier buddrw at kgs.ku.edu
Tue Sep 16 12:44:20 EDT 2003

- Previous message: [Coral-List] Porite genome 2
- Next message: [Coral-List] coral genome
- **Messages sorted by:** [date] [thread] [subject] [author]

I have been following this discussion with some interest. Since I know relatively little about the potential application of genomics, this may be an ignorant question, but ----

What good will it do us, in the larger sense, to get the genome of a threatened or endangered or or regionally local or endemic species? Wouldn't interpreting the significance of those results (in terms of vunerability or survival or distribution) require a lot of other genetic information before you could start to reap the benefits?

It seems to me that a preferable strategy would be to go for a widely distributed, cosmopolitan species and than look for significant differences in the more specialized or localized or sensitive species. In that sense, Porites lobata (or one of the widely distributed Indo-Pacific acroporids or pocilloporids) would seem to me to be as good a choice as any, although the thorny question of species identification in the morphological and environmental senses will certainly rear its head whatever you choose to look at.

This would seem to me to put the project into a global, longer-term reef research and preservation framework. I have pretty severe reservations about the short-term potential of genome research to come up with a silver bullet that will fend off localized extinctions or reef collapses.

What am I missing about the objectives and potential applications?

Bob Buddemeier

Mike Matz matz at whitney.ufl.edu
Tue Sep 16 17:48:12 EDT 2003

- Previous message: [Coral-List] Porite genome 2

Hi all,

In responce to the questions from Bob Buddemeier, let me try to summarize the two major benefits of sequencing a coral genome:

1. Coral genome would be the major bonus for evolutionary genomics, since corals are representatives of the Cnidaria - sister group to all the currently sequenced metazoans.

2. A basis will be created for molecular studies of how coral works. Of big interest for conservation biology would be molecular mechanisms of stress and resistance, and also molecular machinery of symbiosis between host and algae. Immediate profit would be availability of microarrays to monitor expression of thousands of genes, which would be a great tool for fine characterization of various coral conditions and stresses.

For wide scientific community, the first benefit is definitely the most interesting, while the second is more for the specialists in reef biology.

Main candidates nominated for genome sequencing:

Acropora sp (millepora?)
Montastraea sp (annularis/faveolata?)
Porites sp (lobata?)

Let's try to compare them, The model should have the following features:

1. should have small genome;

2. should be easy to work with basic molecular techniques such as RNA and DNA isolation;

3. should be amenable to at least to in situ hybridization techniques and to RNAi techniques - to study gene expression patterns and knock the genes down, at least locally and temporarily.

4. Should be easily kept in the lab, preferrably growing.

5. Should be itself widely distributed and ecologically significant, or be a representative of a closely related group of ecologically significant species, so that sequence information from the genome project could be usedfor studies in many places and many similar species.

6. Existence of other relevant molecular projects, such as EST sequences.

7. Popularity of the species in general as a model for various non-molecular research.

8. Ultimately, the species should be reproducible in the lab, completing full life cycle in less than a year, and amenable for transgenic manipulations.

Please add your requirements if you feel necessary.

Discussion:
1. Small genome: to my knowledge, most corals have genomes of similar or at least comparable sizes, most common 2n number of chromosomes being 28. So the first issue would not matter much for most candidates. Montastraea is 2n=28, as are most Acroporas, I wonder about Porites.

2. RNA-DNA isolation: Craig says Acroporas are difficult in this respect. Montastraea and Porites seem to be OK. I have a feeling that generally, this and the next issue (in situ hybridization and RNAi) would work the better the meatier is the coral, so I favor Montastraea (especially cavernosa - thefattest coral I ever worked with). Still, to my knowledge, nobody ever attempted in situ hybridization or RNAi on coral (please let me know if I'mwrong!)

4. All the three candidates are nicely living in the lab, acropora grows fastest, montatraea - slowest. Acropora seems to be more gentle than the other two.

5. None of the candidates has a single species that is distributed eveywhere. At least there is a limitation either to Caribbean or Indo-Pacific. Still, at the generic level, all three genera - Acropora, Porites and Montastraea - are distributed worldwide and are of the most important reef-builders. Acropora model would represent the most species-abundant genus (some 250 species), which is good. Porites comes second in species numbers (some 50 species), and Montastraea - last, some 10 species. There is a slight downside of using representatives of species-rich genera - there are more taxonomic difficulties there, but this would not matter much for our situation, I quess.

6. Existence of supporting molecular projects is a Very Important Issue indeed. We don't get too much money for coral molecular biology in general, so it would be much better to stay focused. To my knowledge, there are some EST projects going on Acropora millepora (although I don't know what the status is) and another is just coming up on Montastraea annularis. I heard nothing about molecular work on Porites. This was the main reason why I was so skeptical about Porites candidate in the beginning.

7. Popularity: Acropora is definitely the star, Montastraea annularis comes second. Porites seems to lag behind.

8. The ultimate requirement. I am not aware of any coral that would fulfill it.

Conclusion: there is no formally best candidate, so the choice would depend on how one would weight the above considerations. I tend to put more weight into general popularity and existence of other molecular projects, so, in my view, Porites is not a good candidate. In all other respects, Acropora seems better than Montastraea, except for the notion that it might be more difficult to do molecular work, which would be very bad indeed. Could anybody confirm this?..

cheers,

Mike

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Coral-List] Coral genome

Ernesto Weil eweil at caribe.net
Tue Sep 16 21:20:16 EDT 2003

- Previous message: [Coral-List] New--Integrated Monitoring Network: SEAKEYS, CREWS data online
- Next message: [Coral-List] Porites genome
- **Messages sorted by:** [date] [thread] [subject] [author]

I'd like to add my 3 cts.in my opinion, as Andy and Mikhail said, if a Caribbean species is to be sequenced, then Montastraea faveolata ought to be the general obvious choice. Second in the list will be A.palmata or Porites porites / P. astreoides, two other very common and widespread species.

EWeil.

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shashank Keshavmurthy iamshanky15 at yahoo.com
Wed Sep 17 08:52:14 EDT 2003

- Previous message: [Coral-List] coral genome
- Next message: [Coral-List] coral genome
- **Messages sorted by:** [date] [thread] [subject] [author]

Dear listers,
I have been following the discussion of the coral genome as to which coral has to be sequenced and why porites lobata may not be a better candidate..... Well... as a student...and a coral biology researcher, I am happy for the sequencing idea, whatever may be the coral species.....

As to why I would like to support this particular sequencing is I will be interested in continuing my studies on Pink-Line Syndrome that we have been observing in Kavaratti Atoll, Lakshadweep Islands, India, in Porites lutea every year (cousin of Porites lobata?)....
Though a cynobacteria species associated with this syndrome has been isolated, still we believe that this is some kind of a immune response of this species.....as for as the syndrome is concerned, it is found only when the coral is in intense stress (high temperature, algal dominated areas)....once coral is out of stress, the pink line disappears..... We have found high amount of proteins in the effected corals.....We also believe the increased presence of HSPs during this phase......Hence, I am fully supporting this sequencing...

I also beleive that it is the slow growing corals that we have to sequence first....as they have lot of secrets embedded in them!!!!......

Cheers for those involved in this project!!!
Shashank

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"the role of infinitely small in nature is infinitely large"-Louis Pasteur

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Robert Buddemeier buddrw at kgs.ku.edu
Wed Sep 17 12:48:23 EDT 2003

- Previous message: [Coral-List] coral genome
- Next message: [Coral-List] teachers guide
- **Messages sorted by:** [date] [thread] [subject] [author]

Brief followup comments:

Thanks, Mike, for the summary. Seems to me there may a fundamental mismatch between the desire for a growing, reproduce-in-captivity

species and the implicit virtues of a long-lived widespread species. Given the need to get positive results on the first round, experimental feasibility is important -- so I would (reluctantly) step back from Porites and go with Julian's suggestion of Pocillopora, or a robust and well-characterized Acropora. In general that criterion would tend to argue against massive growth forms in the first round.

However, I would like to reinforce Doug's point -- the massive Porites have the greatest colony longevity that has been widely and systematically demonstrated experimentally, and are widely used as environmental sensors. That, plus distribution, plus both geological and ecological importance, should keep them pretty high on the list.

Somebody has to say it, so I'll be the bad guy -- the genus selected should have well-distributed and reasonably important species in both the Atlantic and Indo-Pacific. It might be somewhat defensible to pick a genus that is in the Indo-Pacific and not the Caribbean, but Montastrea just doesn't make it in terms of generalizability.

And, a possibly outdated comment on the message below -- I suspect lobata and lutea may be closer to sibling species than cousins: when I was swimming around in the central Pacific and talking to people who ID corals, the consensus then was that the two grade into each other pretty indistinguishably.

Bob Buddemeier

Doug Fenner d.fenner at aims.gov.au
Wed Sep 17 10:44:10 EDT 2003

- Previous message: [Coral-List] Coral genome
- Next message: [Coral-List] Porites genome
- **Messages sorted by:** [date] [thread] [subject] [author]

Porites has the advantage that it is an important reef builder in both the Caribbean and Pacific, and the third largest genus of corals. Also, the huge massive Porites are the source of climate records. Acropora is also a major reef builder in both Caribbean and Pacific. It is also the largest coral genus with about 165 species known so far. Montastrea is a major reef builder in the Caribbean, but in the Pacific has only a few small uncommon species. Among the Porites, P. lobata is the most common of the big massives used for climate records, and is one of the most widespread of all corals. P. lobata seems like one of the best choices. -Doug

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Craig Bingman cbingman at panix.com
Wed Sep 17 13:07:37 EDT 2003

- Previous message: [Coral-List] Porites genome
- Next message: [Coral-List] New Version of ReefBase online for evaluation
- **Messages sorted by:** [date] [thread] [subject] [author]

I'm not sure that I understand why a coral that is primarily useful for fossil/paleoclimate studies is the best choice for a genomics project. Personally, I think that the community needs to figure out coral biology's closest equivalent to a "lab rat" or "fruit fly" You need to pick the organism that is most ameniable to laboratory manipulations and studies on living organisms. Or you need to find a target organism that will provide the most useful leads on the reagents needed to do field studies on mRNA's or proteins isolated from specimens in the wild.

If no such reef-forming coral exists, then it is *possible* that the community would be better served by picking another model cnidarian that is more conducive to laboratory manipulation. I'd personally be disappointed if the genomics work was done on something other than a reef-forming coral, but that needed to be said.

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Tonya Shearer tlsnell at buffalo.edu
Wed Sep 17 17:07:32 EDT 2003

- Previous message: [Coral-List] New Version of ReefBase online for evaluation
- Next message: [Coral-List] Porites Genome
- **Messages sorted by:** [date] [thread] [subject] [author]

Having sequenced DNA from many Caribbean scleractinian species, I thought I would add a couple of comments. One consideration when choosing a species is the availability of zooxanthella-free tissue (ideally sperm). In my experience, DNA from the zoox is often amplified (and subsequently sequenced) in

addition to the coral DNA, unless the tissue is free from zoox or the primers are specific to cnidarians. Obtaining gametes from broadcasting species is relatively easy, whereas brooded larvae often already have zoox from the maternal colony. I'm not sure how easy it is to get sperm from brooding species.

My personal preference is for a Porites species, one because I have developed microsatellites for P. astreoides (unfortunately a brooder), and two, because there are several representatives in the Indo-Pacific and Caribbean. Thus this genome can be used as a model for efficiently developing genetic markers for several Porites species. Three, conducting molecular analysis on Porites (at least Caribbean species) is very easy = high amplification and sequencing success (not the case for some other species). Finally, as brooders that release larvae multiple times throughout the year, molecular biologists can take advantage of breeding experiments without having to hope for good weather conditions on the couple of evenings of mass spawning.

I have also developed microsatellites for Montastraea cavernosa. Although technically easier to work with as far as eliminating the concern for zoox contamination by using sperm, I think sequencing a Montastraea genome would on the whole, be less useful for molecular biologists than a species from a more widespread genus.

No matter which species is chosen, this information is extremely useful for those of us that are interested in the genetic structure and gene flow (larval transport) of coral species. For those of you that don't know the struggles of doing molecular work on corals, standard molecular markers used for population genetics on other organisms (mitochondrial genes) cannot be used in corals due to a slow rate of evolution in the mitochondrial genome. Therefore we have to develop other markers, which can take years. Having a model genome available to develop these markers will save time, money and the sanity of those doing the work.

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craigdowns craigdowns at envirtue.com
Wed Sep 17 17:58:18 EDT 2003

- Previous message: [Coral-List] coral genome

- Next message: [Coral-List] New software to calculate parameters of the CO2 system
- **Messages sorted by:** [date] [thread] [subject] [author]

Dear Coral List Serv,

Dr. Cheryl Woodley will be posting a letter soon concerning this issue, but I thought I should give some comment back.

Almost two years ago, we began evaluating criteria for a coral 'lab rat', an organism representative of scleractinians to be used as a model for molecular genetics, cell biology, biochemistry, lipid chemistry, sterol/polyphenol chemistry, environmental/physiological monitoring, ecotoxicology, stress physiology, coral immunity, coral 'oncology', coral endocrinology, and coral neurophysiology. This quest was formalized at the U.S. CDHC's January 2002 workshop and its subsequent National Report. Personally, I've been asking folks with diverse backgrounds such as Eric Borneman and Phil Dusan to Barbara Brown and Yossi Loya since 1999 to "nominate a coral species candidate and justify." Response has been slow coming. I'm a lab biologist – without a lab rat for other labs to repeat my experiments or take the work further, I'm at a standstill, as are other coral laboratory biologists. Everyone who may be associated with field coral biology has suggested 'their' species as the 'best species'. This is understandable. Heck, my vote was for Oculina varicosa.

As a lab rat, the most important criteria is accessibility. Everyone in the world should have relative ease in obtaining 'laboratory strains' of coral. These strains must be genetically identifiable, which means that Strain 1 will come from a single colony from somewhere, and mass cultured. Someone or some entity must then have the facilities to rear this coral in abundance and be able to distribute this coral to any lab in the world that asks for it, whether it be a lab in Eilat, AIMS, or Dalhousie University. The coral must also SURVIVE the trip. As someone who ships and receives corals from all over the world, shipping with the least expense possible of coral that will recover and grow in the lab is an essential reality to consider. Spending $800 (includes tariffs, custom fees, CITES fees, etc..) for a shipment of 150 grams of coral from Miami to India gets old after awhile if your corals arrive dead. Most folks have seen the phoenix effect with Porites, few species besides Gonistrea or Pavona have the resilience of Porites.

Also, the point is not to sequence the genome from a Caribbean coral species, or a Pacific one. This has been mentioned several times, I believe the point is being missed and Cheryl will expound upon that issue further.

Another issue is: can many of the tools of molecular, cellular, and physiological biology be applied to that species? As someone who has had considerable experience in this area, I can say that Acroporas are

ruled out. Next time you run a western on an Acropora sample, and assay for a protein that is cysteine or histidine rich, the really high-molecular weight banding patterns you see are the result of the very rich sulfo-glyolipid composition of Acroporids (ask Carolyn Smith).
As the field of Natural Products Research can attest, evidence argues that these compounds come from the dino, dino 'clades' that are found abundantly in fast growing corals, such as Acropora. These compounds like to adduct with proteins, which makes protein biochemistry in these species difficult. Besides this, Acropora are rich in some very active polyphenols (all symboint corals have these to a lesser or greater degree, depends on your dino), resulting in extensive maillard product formation. This can be seen when you isolate DNA from a number of coral species and you DNA pellet is tan or brown. To correct for this, you add PVPP or borate, but you know that the PVPP isn't that great as a Maillard scavenger and borate comes with its own problems. Some folks have mentioned mRNAsi and perhaps microarrays, these nuances have significant affect on the outcome of your results when using these techniques. All of this is unfortunate, becase as many have pointed out, Acroporids grow extremely fast, and this characteristic would be a tremendous boon.

I've worked and published with Montastrea. Its important ecologically in the Caribbean and in the Gulf of Mexico. Draw back is its continuous mucus production when stressed (and I've stressed Montastrea from everything from atrazine to oil). And since a lot of folks are getting into the stress biology of corals, this is a draw back. More so, the amount of polysaccharide production inhibitors and polysaccharide degrading enzymes you have to add to Montastrea (or Gonistrea) for coralcell culture will make you bankrupt. Coral cell culture is a next bigstep in coral laboratory biology, and the lab rat has to be a good species to which apply these techniques. Acroporids aren't bad, Gary has had tremendous success with Pocillipora, Cheryl Woodley has had success with Oculina, and I with Porites and Occulina. You can put Montipora in this category of high mucus content - funny, few elected for this species. When we tried to heat stress Montipora on Heron Island to do some bleaching experiments, it was impossible to work with.

Actually, to just argue for a lab rat, Oculina varicosa (or any of its sibling species) would win, hand down. Grows fairly quickly, gets disease, beautiful cell culture, and its not an obligate symbiont, something that is extremely advantageous when wanting to do in vivo experiments and not having the presence of the to dino interfere, such as during physiology investigations. Oculina on protein gels/westerns or running it on a GC-MS for lipid analysis, beautiful! Unfortunately, its not a major tropical reef builder, and it doesn't handle shipping very well.

So from a lab technique perspective, again, Porites exhibits the least amount of technique artifact(Oculina less so), and can be shipped using a wet paper towel, plastic breather bag, and blue ice with highest success of survival after shipping.

To move into the realm of physiological ecology, environmental assessment, Acroporids and Porites are found in abundance worldwide, though Porites can be found in cooler climes than Acropora (just got to Bermuda or western Costa Rica). Problem with Acropora is that for the most part, they are not resilient species, and are the first to crash during an environmental event, whether that event be an unusually high SST or an oil spill. So if you're looking at a system to gauge its recovery (process), then you need a species that will be around after the environmental event (Jessica diesel spill in Galapogos, or Okinawa after 1998 El Nino).

Objective and potential applications.This seems to be an issue, but I can't understand why. The sequenced genome is a platform, a platform to extend basic research into areas of coral biology where it has been so difficult to conduct in the past, or a platform to develop new technologies to allow us to see further (is this coralimmunocompetent or endocrine modulated? How will you assay for this? We need the genes that contribute to these systems to better explore their individual and combined behavior). Cnidarians have the most priminite nervous system. How are their neuropeptides different from ours, and why? Corals also get hyperplasias whose tissues (and their composition) are radically different from 'normal' polyps. Can our understanding of cancer in mammals be aided by our understanding and the future discoveries of how corals get 'cancer'? These basic science questions can be greatly aided by knowing the sequence of the coral genome. Look at the magnitude of success genomics has brought to human biology, yeast biology, drosophila biology, C. elegans biology, etc..

The technologies that can be developed from a sequence coral genome are.well, you're only limited by your imagination and determination. Here is an example: some anti-foulant components in boat paint may be having an adverse affect on corals. Some of these components are cyanobacteria biocides, or just general biocides. Corals (all the way up to us) have as part of our innate immunity the production of anti-microbial, anti-fungal, anti-botanical compounds. Some of these are polyphenols, while others are polypeptides. If you can elucidate the biochemicalpathway or obtain the gene(s) to the proprotein that creates theseanti-microbial, anti-fungal, anti-botanical compounds from coral, its possible that you could encapsulate these polypetides into a nano-structure (capsule) to be added to the paint instead of using something like TBT. You would be using the coral's own anti-foulant chemistry on your boat - and since corals make it, there is a lower probability of toxic side affects on the corals themselves (but that would have to be determined experimentally).

I hope this help in understanding the position we've taken (Cheryl's letter will reinforce points I had to gloss over).

I also want to point out that the deadline is fast approaching for letters of endorsement and look forward to receiving them.

Sincerely,

Craig

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Saving Tomorrow Today

Julian Sprung julian at twolittlefishies.com
Wed Sep 17 21:10:48 EDT 2003

- Previous message: [Coral-List] New software to calculate parameters of the CO2 system
- Next message: [Coral-List] coral genome
- **Messages sorted by:** [date] [thread] [subject] [author]

Dear Mike,

Regarding requirement 8, what about Pocillopora damicornis? It reproduces prolifically (by asexual formation of planula larvae), and aquarium spawned colonies can reproduce this way in a year or less. It is also very widespread and easily cultured in aquariums.

Julian Sprung

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capman at augsburg.edu capman at augsburg.edu
Wed Sep 17 14:07:03 EDT 2003

- Previous message: [Coral-List] coral genome
- Next message: [Coral-List] coral genome
- **Messages sorted by:** [date] [thread] [subject] [author]

I'd like to add to Julian's endorsement of Pocillopora damicornis as a potentially good model system:

1. P. damicornis is a fast growing coral in aquaria, and very adaptable to varying conditions. Not quite as fast growing as the fastest Acropora species I have grown, but very fast nonetheless.

2. P. damicornis (at least the clones I have grown, which are commonly available clones from the aquarium trade) has a finer

branching structure than most of the Acropora species, which means even a modest-sized colony can be fragmented into many very uniform-sized branch-tips for starting replicate, genetically identical colonies for lab work. Within a year, each of these new colonies could be fragmented into at least a dozen (or more likely *dozens*) of new colonies.

3. Following up on point 2 above, even very small fragments of P. damicornis (with as little as just a few polyps) can be used to start a new colony, and attachment to new surfaces is rapid (typically resulting in sheeting growth to anchor the colony before substantial branch growth occurs). In contrast, most Acropora species have thicker branches, fewer branch tips, and much larger fragments (longer fragments) are usually necessary in order to start a successful new colony.

4. P. damicornis has a high density of large (for a small-polyped stony coral) long polyps, giving the colonies a very fuzzy appearance. What is important here is that these polyps are almost always well extended. In addition, P. damicornis colonies are relatively unbothered by handling, or vibrations. With many (most?) corals, if you pick up a colony and put it into a dish of water for viewing under a low-power microscope, the polyps retract and don't extend well for some time...and even when they do extend again vibrations from working with them on the microscope will cause them to contract again. In contrast, P. damicornis will retract only partially if handled gently, but then within minutes the polyps will be fully extended again, and will typically stay extended even while being worked with on the microscope. For this reason, P. damicornis is the absolute star performer in my teaching labs (where we have about 50 species of growing corals to choose from) for demonstrations and other activities where I want students to be able to work with live, fully extended coral polyps. I can even break fragments off of large colonies just before class and usually have extended polyps during class.

5. Following up on point 4 above, the long, nearly always extended polyps of P. damicornis are very transparent except for their zooxanthellae (and the pale polyps from lower shaded portions of healthy growing colonies are almost completely unobscured by zooxanthellae, and the polyps from the most intensely illuminated branch tips are relatively low in zooxanthellae as well). I would think that these polyps would be perfect for studies of gene expression in which genes of interest have been linked, for example, to genes for bioluminescence, so that cells expressing a given gene will glow. Live healthy colonies of such genetically modified P. damicornis could be viewed under low-power microscopes, with very clear complete views (both top views and side views) of fully extended polyps, so it should be possible to not only see when genes are turned on and off, but also see precisely where in the polyps this is happening.

Bill Capman
Augsburg College

Minneapolis, MN

EricHugo at aol.com EricHugo at aol.com
Thu Sep 18 00:34:59 EDT 2003

- Previous message: [Coral-List] coral genome
- Next message: [Coral-List] Porites genome
- **Messages sorted by:** [date] [thread] [subject] [author]

In a message dated 9/17/03 7:31:27 AM, julian at twolittlefishies.com writes:

Regarding requirement 8, what about Pocillopora damicornis?

Recongizing the length of this thread, I hesitate to add to it, but I agree with this, as well. P. damicornis and S. pistillata arguably are already virtually "coral guinea pigs" and are widespread, important hermatypes, and have a large literature base associated with them.

In the Caribbean, I also agree that the acroporids and Montastraea are the logical choices. In fact the corals mentioned above were already selected by CHDC as candidates for coral "lab rats" in culture.

As perhaps mentioned, their life histories are also perhaps more representative of the majority of corals.

Best,

Eric Borneman
University of Houston

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julian julian at twolittlefishies.com
Thu Sep 18 14:23:20 EDT 2003

- Previous message: [Coral-List] Coral genome
- Next message: [Coral-List] Coral genome
- **Messages sorted by:** [date] [thread] [subject] [author]

I agree that Porites spp. have numerous advantages, and also that Pocillopora is not nearly as durable in transit as Porites. It is in fact a bit delicate in this regard, and is susceptible to Vibrio infections. Porites does make the most sense based on the criteria given.

For the heck of it I'd like to add a name to the discussion since it hasn't been mentioned so far, possibly because it is not so "in your face" as Acropora and Porites, or possibly because no one is really sure how to pronounce it- Psammocora. This genus is widespread globally, easy to grow, easy to ship, and has a Phoenix/reincarnation capacity at least as good as Porites. I'm not sure about its sperm production though!

Cheers,

Julian

Doug Fenner d.fenner at aims.gov.au
Thu Sep 18 17:40:24 EDT 2003

- Previous message: [Coral-List] coral genome
- Next message: [Coral-List] Coral genome
- **Messages sorted by:** [date] [thread] [subject] [author]

Stylophora pistillata has been used extensively in experiments on metabolism and zooxanthellae - in the Bali symposium it was even referred to as the coral lab rat. It is also widespread in the I-P, though not as wide as P. damicornis, but the genus is not in the Caribbean. I have no idea on how easy it is to reproduce in an aquarium or use for genetics. There are only about seven species in the genus and they generally don't dominate reefs.

There are no Pocillopora in the Caribbean. There are about 17 species in the genus and while important in the eastern Pacific the genus is less so elsewhere.

PS - Veron recognizes 165 species of Acropora in his Corals of the World(2000), Wallace recognizes 114 in her Staghorn Corals of the World (1999). Many more names have been applied, but many or all of these are synonyms and don't represent additional species. New species will no doubt continue to be described and some may be 'rediscovered' among the names thought to be synonyms.

-Doug
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Phil Dustan dustanp at cofc.edu
Thu Sep 18 15:31:27 EDT 2003

- Previous message: [Coral-List] Coral genome
- Next message: [Coral-List] Coral genome
- **Messages sorted by:** [date] [thread] [subject] [author]

>Hi Everyone,
I've been watching this scene develop for a few days and I'd like to point out that the proposed sequencing effort of Porites lobata is a real plus for coral biology. When everyone jumps in and wants "their favorite" instead of the proposed species. This is just one more example of the coral reef scientific community eating its young. In other disciplines researchers get squarely behind their colleagues and help them promote an idea. They work together for the greater good. The coral reef community has accomplished far less than it could over the years because it tends to snipe, and snipe and snipe until everyone gets tired of defending their ideas and the funding agencies go away confused and end up funding geologists or chemists or astronomers.

Why not get behind Gary and Craig and realize that success with the first species will help everyone move forward and the others will follow if there is meaningful knowledge to be gained from it.

Get a grip people. Put your ego aside and support the project.

Phil

David Obura dobura at cordio.info
Thu Sep 18 18:39:21 EDT 2003

- Previous message: [Coral-List] Porites genome
- Next message: [Coral-List] Coral genome
- **Messages sorted by:** [date] [thread] [subject] [author]

Dear all,

Like Bob, I_ve been following with some interest, and it helps to have Mike Matz_ full Œcriteria_ laid out. At the risk of being labelled Œcoralist_ I cannot see the value in selecting a species/genus that is minor in the global sense, which Montastrea is. In the long run it probably does not matter about the ecological importance of the first species to be used, but it does matter about its phylogenetic

pedigree, and any current/immediate-future work related to gene-environment processes. To my mind, this would put Porites, Acropora and Pocillopora at the head of the list, in roughly that order, with one of the more prominent faviid genera (Favia, Favites, Platygyra) next.

Many of the genetic/methodological criteria Mike mentioned may not be known yet for either Acropora or Porites in which case why not do preliminary trials on a short-list of 3-5 species before commiting to any one surelythe costs would be worth it. In the end, my expectation would be that a Porites species would come first as these are widespread and phylogenetically and ecologically important (whether the massives, for which we can have climate records and can relate genotypes to historical conditions, or the branching ones cylindrica for example - which satisfies more of the Œlab-rat_ criteria). Second would come one of the widespread Acropora head/cushion species with relatively broad environmental tolerance, or Pocillopora damicornis, the lab-rat par excellence.

As Shashank has noted, Porites do have some pretty interesting syndromes in the field that would make genetic studies interesting the pink colouration he mentions, abundance of growth tumours, permanent white patches that nevertheless grow, generation of mucus sheaths of mysterious function, the most plastic and Œgentle_ general bleaching responses that I have seen (both to SST and sediment), among the broadest temperature acclimation range
worldwide, probably the longest lifespan while also being viable while small, senescence??, probably the most likely candidate for Œadaptive bleaching_ ... there are probably more. Most other genera/species just seem to do their thing quietly and consistently. Porites lutea is the one Ithink I_ve been looking at for years rather than lobata ...

Now catching up with later responses perhaps Porites cylindrica (or otherbranching Porites) might do better, satisfying the distribution and lab-ratrequirements, having the Œinteresting ecology/evolutionary history_ criteria above, as well as being workable.

David Obura

--

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Szmant, Alina szmanta at uncw.edu
Fri Sep 19 11:51:59 EDT 2003

- Previous message: [Coral-List] Coral genome

- Next message: [Coral-List] Welcome to the 10th International Coral Reef Symposium!
- **Messages sorted by:** [date] [thread] [subject] [author]

Hi All:
I have been following the thread for selecting a scleractinian coral species for the coral genome project, and just wanted to point out that the idea that one coral species can be a representative lab rat for physiological etc studies of "corals" is flawed by not considering the evolutionary history of extant corals. This is not a monophyletic group from what I've read. Furthermore, the different families can be so totally different ecologically and physiologically (and obviously genetically, as was detailed by Craig Downs) that I do not buy that results from one species can be extrapolated to responses of species of different groups. While we have to start somewhere with a single species, there is no one species that is going to be representative of corals in general. With time and as $$ becomes available we need to do as many others as is fundable (hopefully selecting for each new initiative an example from a different family). While I work only in the Caribbean and would love to see one of the Montastraeas or Acropora palmata worked on, most reefs (and corals) are in the Pacific region, so I think it best to start with a species from that region. Furthermore, some of the criteria that Craig suggested for the selected species (ease of culture, shipping survivability) are more important in terms of getting as much generic benefit from the genetic results than are the ecological or regional importance of the species.
Alina Szmant

Pedro Alcolado alcolado at ama.cu
Fri Sep 19 12:39:05 EDT 2003

- Previous message: [Coral-List] Coral genome
- Next message: [Coral-List] Porites genome
- **Messages sorted by:** [date] [thread] [subject] [author]

I support Dustan´s recomendation. Do not dilute initial efforts.
Pedro Alcolado

Cheryl Woodley Cheryl.Woodley at noaa.gov
Fri Sep 19 19:13:16 EDT 2003

- Previous message: [Coral-List] Information request
- Next message: [Coral-List] Welcome to the 10th International Coral Reef Symposium!
- **Messages sorted by:** [date] [thread] [subject] [author]

Dear Coral List Members,

First, I'd like to say that the postings have been worthwhile, informative, and have provided very valid points on alternative species. I am encouraged to see such an interest in coral genomics. I also appreciate Tonya Shearer commenting on her sequencing experience that can influence logistics considerably.

I think that the discussions have also served to point out that those of us immersed in genomics everyday need to better convey the power and potential of the technologies (to which we've become so accustomed) to researchers in other scientific disciplines as well as being able to articulate the applications that become possible from this type of endeavor to managers and policy makers. I appreciate Mike Matz summarizing a few of the many benefits of having this resource (I would even add benefits to fields such as comparative- immunology,- physiology, -biochemistry and providing the means to develop new tools/technologies such as diagnostics and field dipstick technologies).

However, in regard to the effort being made to have a coral genome sequenced, I am concerned that we may have lost sight of the real goal: that is to generate vital coral genome sequence data and make it widely available to the research community via the public domain.

We have a window of opportunity right now to respond as a research community to say that, yes, a coral genome needs to be sequenced and we as a coral research community will use these resources to move the field of coral research and conservation management forward. This window will close October 9, 2003.

Dr. Gary Ostrander and the other collaborators have worked to put together a proposal to have a coral genome sequenced and are simply asking for support of their proposal from the coral community to go forward to NHGRI, the National Human Genome Research Institute. Currently there are 20 fully sequenced eukaryotic genomes with dozens more under development. Passing up the opportunity to add a coral genome to the list at this point, would only serve to leave the coral research community behind the times, in the future.

In all, this is a very important effort and meets a major mandate of the Coral Disease and Health Consortium's National Research Plan. The completion of a genomic sequence will have many positive effects on the field of coral research and others, many of which cannot be foreseen today. So please let's pull together in support of this effort that we all will benefit from either directly, by those involved in genomics and proteomics work, or indirectly, by building on the discoveries made from this unique resource.

Sincerely,
Cheryl Woodley
Chair, Coral Disease and Health Consortium

David Obura dobura at cordio.info
Tue Sep 23 13:15:39 EDT 2003

- Previous message: [Coral-List] Coral Spawning Report
- Next message: [Coral-List] coral reef monitoring for management *we need your help*
- **Messages sorted by:** [date] [thread] [subject] [author]

This discussion illustrates one thing the list is useful for. As Craig Downs said, they tried to get some input on species selection before, but without much effect. Unless this discussion goes further than it has to
date, this input will also in the end be pretty minor. It is not a matter of diluting current efforts for personal favourites, but pursuing a productive dialogue on the pros and cons of different species/models. But this has gone as far as is useful in totally open forum.

The next step, to my mind, would be for the originators of the discussion to take it off-list with the various people who have taken time to respond. Try and get some consensus from the laboratory and field people on balancing the criteria, and come up with one or two sets of corals from which further genome work can proceed. And also, of course, select the Œbest_ species for now and endorse their current proposal. This group can also (and this would be much stronger than individual letters), endorse the proposal to the funders to at least start with something. Meanwhile, the recommendations/findings of the group can be reported back to the list, and from additional responses to that, a core group of genome researchers may have identified themselves and start their own networking process.

Some discussions on the list do peter out in acrimony (which this one is now tending towards), but this one is focussed and could be very productive.

Sincerely,

David Obura

David J Miller david.miller at jcu.edu.au
Mon Sep 29 12:07:43 EDT 2003

- Previous message: [Coral-List] NIUST RFP for marine biotech/technology proposals
- Next message: [Coral-List] research assistant position
- **Messages sorted by:** [date] [thread] [subject] [author]

Dear All

I very recently became aware of this discussion forum, hence my late entry to the coral genomics debate. I thought Mike Matz did a good job in raising some of the pros and cons of the various proposed model corals, but there are a few things that maybe should be more widely known than they appear to be.

First, there seems to be the misapprehension out there that a coral genome would be the first cnidarian genome to be sequenced. This is not the case; it is extremely likely that a current bid to sequence the genome of the sea anemone Nematostella vectensis will be successful. All of the cnidarian evo-devo community has strongly supported this application, and I would be very surprised if it is not funded. This animal has special advantages for evo-devo studies, hence the universal support for the Nematostella sequencing initiative.

Second, as Mike previously pointed out, it's really important that the 'homework' is done before a coral genome proposal goes forward. By this I mean that it is essential that parameters such as the approximate genome size are known; note in the case of Hydra species, H. viridis has a genome that is one quarter the size of the more widely studied H. vulgaris and H. magnipapillata. Note also that genome size is not a function of the number of chromosomes - it's just that the chromosomes of H. viridis are smaller than those of the other species. No one should seriously consider using H. vulgaris for a sequencing project, despite its popularity otherwise; a bid to sequence H. viridis will go forward very soon. Similar criteria should apply in the case of a coral.

Mike also pointed out the requirement or desirability of technology and tools for the coral selected. Please consider the advantages of the coral that we work on, Acropora millepora, in this respect. Acropora is the second best represented cnidarian in the databases (behind Hydra). Indirect estimates put the genome size as small - comparable with the fruit fly and roundworm, and therefore at the low end of cnidarian genome sizes. Most corals have the same number of chromosomes, but those of A. millepora are particularly small. Also, most of the molecular tools are there for A. millepora - genome libraries in lambda and cosmid vectors, cDNA libraries for six different embryonic and larval stages (as well as adult colonies), and an extensive EST dataset. Microarrays featuring 3,000 ESTs of known sequence are presently available (mail me if you want details of this), and the sequences of these clones will be available shortly; note that we have been holding off releasing these until the first paper is accepted, and that we expect to hear that this has happened within two weeks. The first batch of ESTs was from planulae, and at present we are generating ESTs from other libraries. In addition, thanks to Eldon Ball's efforts, in situ hybridisation technology works wonderfully on A.millepora, whereas I do not believe this method has been established for any other coral. Therefore in terms of the molecular basics being in place, Acropora is a much more

advanced system than is any other coral, and I am quite sure that the evo-devo community would strongly support a proposal to sequence the genome of this coral. Before putting forward such a proposal, however, we intend to accurately determine the genome sizes of a range of Acropora and other coral species. It should be possible also to do this for any coral for which zooxanthellae-free cells can be isolated.

I don't wish to discount the Porites lobby but, for a coral sequencing initiative to be successful and useful, the molecular parameters outlined above are particularly important.

Regards...

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